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Review of progress achieved in implementation of Agenda 21 and the Johannesburg Plan of Implementation: transport

Report of the Secretary-General

Summary

Transport and mobility are essential preconditions for sustainable development. While transport is often associated with environmental and social costs, the lack of adequate transport infrastructure and affordable transport services is contributing to poverty and posing major obstacles to the achievement of the Millennium Development Goals, particularly in developing countries. In addition, globally increased urbanization and motorization over the past several decades have resulted in an unprecedented rise in emissions, leading to degradation in living conditions worldwide and accelerating the process of climate change. Global population growth contributes further to these trends. Appropriate policy interventions are urgently needed to establish affordable, economically viable, socially acceptable and environmentally sound transport systems. It is crucial that multimodal systems emphasizing low-energy modes of transport be developed and that increased reliance be put on public transport systems. Integrated urban and rural transport planning, as well as supportive fiscal and regulatory policies, paired with the development of new technologies and greater international cooperation, are key factors for achieving a transport sector that meets the requirements for sustainable development.

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I. Introduction

1. The present report is a review of the state of implementation of the goals related to the thematic area of transport, as contained in Agenda 21,[1] the Programme for the Further Implementation of Agenda 21[2] and the Plan of Implementation of the World Summit on Sustainable Development (Johannesburg Plan of Implementation).[3] It is designed to be considered in conjunction with the corresponding reports on chemicals, waste management, mining and the Ten-year Framework of Programmes for Sustainable Consumption and Production under the Marrakech Process, which are also before the Commission on Sustainable Development at its current session.

2. The report draws on substantive contributions from United Nations programmes and agencies, in particular the United Nations Centre for Regional Development, the United Nations Environment Programme (UNEP), the United Nations Human Settlements Programme (UN-Habitat) and the World Health Organization (WHO), and on regional assessments prepared by the five United Nations regional commissions. The United Nations Conference on Trade and Development (UNCTAD), the United Nations Development Programme (UNDP), the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) also contributed assessments in their respective sectors. Most of these organizations were also represented at the Expert Group Meeting on Transport for Sustainable Development: Analysis of trends, issues and policy options, which had been organized by the Department of Economic and Social Affairs in New York, on 27 and 28 August 2009.

3. The report also benefited from information furnished by the World Bank Group and other international financial institutions, as well as from country and national assessments submitted by Governments and from inputs of major groups.

II. Review of implementation

4. Transport and mobility are essential preconditions for economic growth, social development and global trade. However, they are also often associated with significant environmental impacts, including atmospheric pollution; thus, they pose major challenges for the achievement of sustainable development.

5. Transport is considered in chapter 7 "Promoting sustainable human settlement development" and chapter 9 "Protection of the atmosphere" of Agenda 21 and in chapter 3 "Changing unsustainable patterns of consumption and production" of the Johannesburg Plan of Implementation. Sustainable development requires a comprehensive and integrated approach to policymaking and decision-making, with a view to developing adequate, efficient, economically viable, socially acceptable and environmentally sound transport systems, as envisaged in decision 9/3

[1] *Report of the United Nations Conference on Environment and Development, Rio de Janeiro, 3-14 June 1992*, vol. I, *Resolutions Adopted by the Conference* (United Nations publication, Sales No. E.93.I.8 and corrigendum), resolution 1, annex II.

[2] General Assembly resolution S-19/2, annex.

[3] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex.

"Transport", which had been adopted by the Commission on Sustainable Development at its ninth session in 2001 (see E/2001/29 and E/CN.17/2001/19), and reiterated by the World Summit on Sustainable Development in 2002.

6. Significant new challenges have emerged since the Commission reviewed transport and energy at its ninth, fourteenth and fifteenth sessions (2001, 2006 and 2007). First, for the past two years global energy markets have been highly volatile, a situation that has had significant impacts on the transport sector. Second, the recent global financial crisis and its negative impacts on employment and disposable income have led to declining demand for various goods and services, a situation which again has had significant negative economic impacts on many transport businesses and service providers. Third, recent scientific evidence of the negative impacts of anthropogenic greenhouse gas (GHG) emissions has resulted in calls for urgent global action to curb the projected growth in emissions, including those of the transport sector. Sustainable development requires very substantial investments in transport infrastructure, as well as an accelerated transition towards low-carbon transport systems.

A. Trends, facts and figures on transport

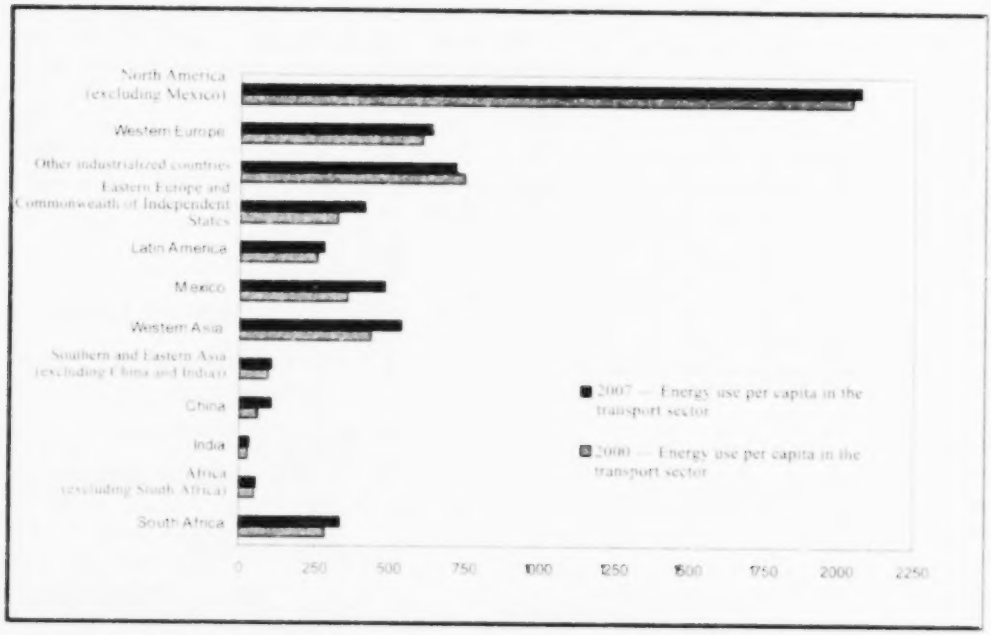
7. Economic activity, globalization, national and international trade and transport are closely interlinked. Since 1971, the use of energy for transport globally rose steadily by 2-2.5 per cent per annum, closely reflecting the global economic growth rates over that period. Road transport accounted for most of the energy used and this sector experienced the highest rate of growth in absolute terms. Aviation was the second largest user of energy; its use increased the most in relative terms.

8. Different countries and regions of the world show very diverse patterns of transport activity, with large disparities in national and per capita use of energy for transport, depending on the amount of travel undertaken, as well as on the modes of transport and types of fuels used. In North America energy consumption for transport exceeded 2,000 kilotons of oil equivalent (ktoe) per person in 2007, whereas consumption in some developing countries, such as some in Africa, averaged fewer than 100 ktoe per person annually.

9. According to data compiled by the International Energy Agency (IEA), the use of energy for transport in industrialized countries grew by an average of 1.2 per cent annually between 2000 and 2006, whereas in developing countries it increased on average by 4.3 per cent annually during the same period.

10. The transport sector relies on oil and petroleum products for more than 95 per cent of its energy needs. Gasoline and diesel are very effective transport fuels, providing high energy density and relatively easy handling characteristics. Over the past 20 years oil prices have on average been low when compared with available alternatives, a situation which contributes to a growing dependence on oil of the entire transport economy.

Figure I
Energy use (kilotons of oil equivalent) per capita in the transport sector: 2000-2007



Source: International Energy Agency World Energy Statistics and Balances 2009 (www.iea.org/stats/index.asp).

11. Transport is responsible for an estimated 23 per cent of global energy-related GHG emissions, with motor vehicles accounting for about three quarters of that amount. Over the past decade, GHG emissions of the transport sector have increased at a faster rate than emissions of any other energy-using sector.[4] While the average per capita transport emissions in the industrialized countries listed in annex I to the United Nations Framework Convention on Climate Change[5] amounted to 3,283 kg of carbon dioxide equivalent (CO_2-eq) in 2007, such emissions in developing countries have been estimated to be only 356 kg of CO_2-eq for the same period.

12. From 1990 to 2005, the stock of motor vehicles globally grew by about 60 per cent, or an average of 3 per cent per year; in most countries the growth was dominated by gasoline-fuelled vehicles. The current total stock of private light-duty vehicles worldwide is estimated to be 800-900 million; it is projected to continue increasing to as many as 1.8-2.5 billion vehicles by 2020.[6] Ownership of private motor vehicles and motorized mobility are strongly related to disposable personal

[4] See Intergovernmental Panel on Climate Change (IPCC), Bert Metz, Ogunlade R. Davidson, Peter R. Bosch, Ratu Dave and Leo A. Meyer, eds., *Climate Change 2007: Mitigation of Climate Change*, Contribution of Working Group III to the Fourth Assessment Report of the IPCC, Cambridge, United Kingdom, and New York, Cambridge University Press, 2007.

[5] A/AC.237/18 (Part II)/Add.1 and Corr.1, annex I.

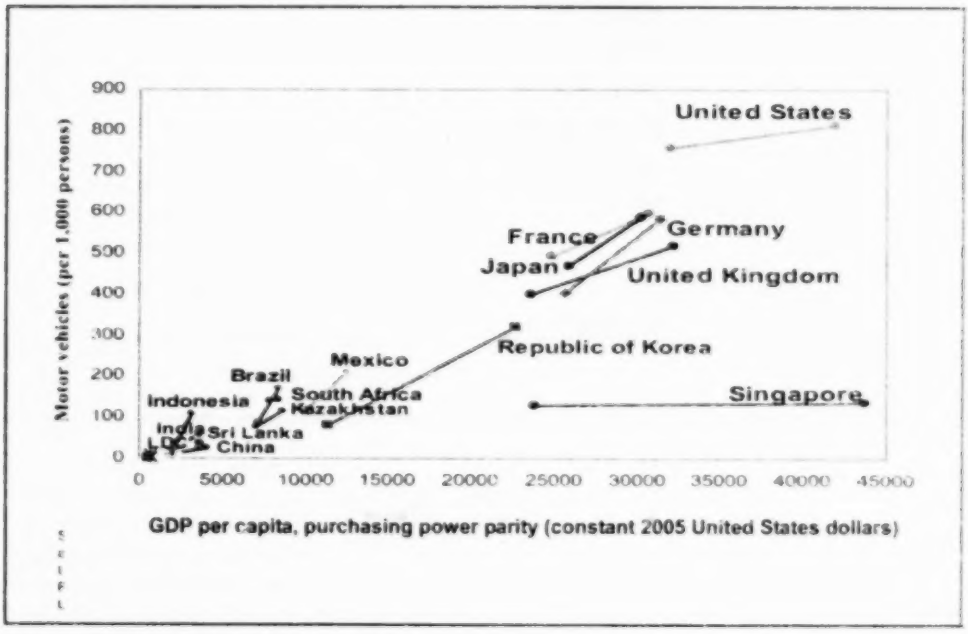
[6] Daniel Sperling and Deborah Gordon, *Two Billion Cars: Driving toward Sustainability*, New York, Oxford University Press, 2009.

income. In almost all developing countries, ownership of private motor vehicles is still very low, and the types of vehicle used are mostly small in size and in engine capacity.

13. In spite of the rapid growth of investment in transport infrastructure, land transport indicators produced by the World Bank and others suggest that rail and road infrastructure, including bridges and tunnels, are still very inadequate in many developing countries, where often less than half the roads are paved.

Figure II

Ownership of private motor vehicles and GDP per capita: 1990-2005



Source: *World Development Indicators, 2008*.

[a] Motor vehicles include cars, buses and freight vehicles but not two-wheelers.

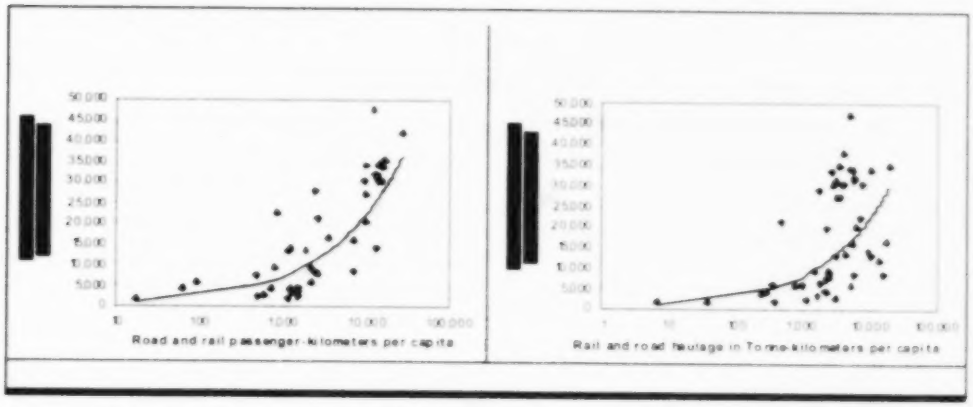
[b] Population figures refer to the mid-year population in the year for which data are available.

[c] United States data are from the United States Federal Highway Administration.

[d] The least developed countries included are Bangladesh, Ethiopia, Rwanda, Senegal, Sierra Leone and Uganda.

Figure III
Economic activity and motorized mobility (2006)

Figure IV
Economic activity and motorized freight (2006)



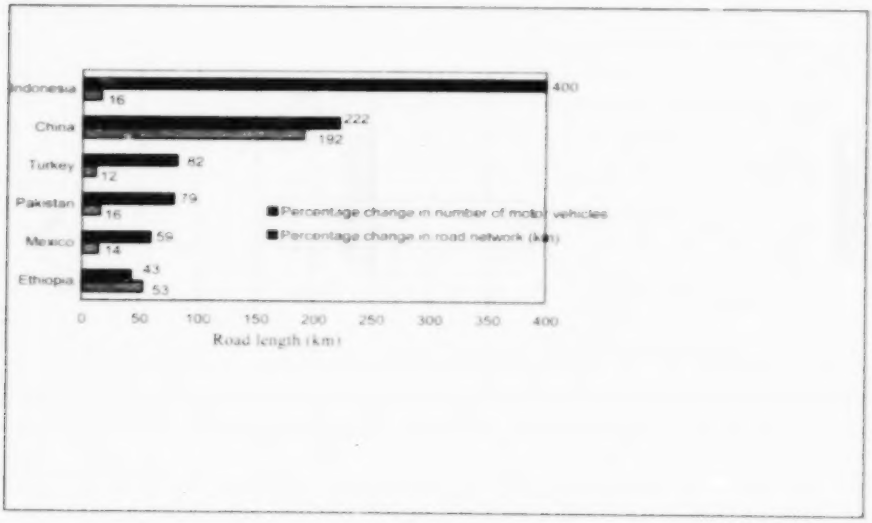
Source: World Bank, *Human Development Indicators 2008* Washington, D.C., World Bank, 2009.

14. In many low- and middle-income developing countries, road networks are increasing in length, by about 2 per cent annually on average. In India and China, the length of roads grew by some 4 and 6 per cent per annum, respectively, during the past decade. While road infrastructure remains inadequate, vehicle ownership and registration have been increasing rapidly. In the past four years, the motor vehicle population in India has grown by about 12 per cent per year and in China by about 20 per cent per year.[7] Most of the additional vehicles are being used in large cities, further aggravating the already serious problems of traffic congestion, inefficient fuel use and high accident rates, as well as air and noise pollution. In spite of the various measures taken to control air pollution in the major cities of developing countries, ambient levels of particulate and soot pollution emitted by motor vehicles, as well as dust, are still very high and far more damaging to human health than once believed.

[7] See World Bank, *Safe, Clean, and Affordable ... Transport for Development. The World Bank Group's Transport Business Strategy for 2008-2012*, Washington, D.C., World Bank, 2008.

Figure V

Relative percentage increases in vehicle population versus road length: 1996-2006



Source: World Resources Institute, *EarthTrends 2006* and *World Development Indicators 2009*, Washington, D.C., World Bank, 2009 (www.wri.org/project/earthtrends).

Notes: Data have been taken from the latest year available within the period 2000-2006.

15. Historically, close correlation exists between GDP growth and freight growth. On average, rail systems are significantly more energy efficient in moving freight than other modes of land transport. Since 1970, the average annual growth rate for road freight measured in ton-kms has been 3.5 per cent, while that of rail transport has been only 1.1 per cent annually.

16. Whereas most industrialized countries have an extensive railway infrastructure, often with double tracks and electrification, most developing countries have systems of only limited length, often with single tracks. Several industrialized countries, as well as a number of developing countries, including China and India, have launched major programmes to modernize their railway tracks, locomotives and rolling stock; such programmes may involve the expansion or introduction of high-speed rail systems. However, most developing countries face great challenges in this regard, including financial constraints, which often delay the necessary modernization and expansion of the mostly publicly owned railways.

17. Over the past three decades air transport has grown faster than any other mode of transportation. Volumes of commercial air travel increased by an average of 5 per cent annually during the 1990s. In addition to business travel, domestic and international forms of tourism have grown into a global service industry, with many long-distance trips being undertaken by air. Since 2001, the rise in air travel has periodically been affected by security, safety and health concerns, such as the outbreak of severe acute respiratory syndrome (SARS), as well as by volatile oil prices. However, international airline passenger traffic still grew significantly, that is, by 7.9 per cent in 2007, until the financial crisis began to have an adverse impact on the industry. In 2008, 2.3 billion passengers travelled by air, with most of the travel having been within and between industrialized countries. For 2009 and the

first quarters of 2010, a 3-4 per cent decline globally in passenger travel is expected, along with operating losses for many airlines.

18. International and domestic maritime shipping has also grown rapidly, together with global trade and with the increased integration of the rapidly industrializing developing countries into the global economy. Modern vessels can carry large volumes of cargo; thus, their energy use and carbon dioxide emissions per unit of freight moved are relatively small, even if many cargo ships sail mostly empty on their return journeys. However, high sulphur emissions resulting from the use of low-cost bunker fuel are a cause of growing concern.

19. The liquefaction of natural gas for transport by tankers involves considerable energy loss. During the past 10 years national and international pipeline networks have been expanded as they provide cost-effective and environmentally benign options for long-term high-volume transport of liquid or gaseous fuels. Major new oil and gas pipelines commissioned in recent years include, among others, the Baku-Tbilisi-Ceyhan pipeline (from Azerbaijan through Georgia to Turkey), the Kenkiyak-Kumkol pipeline (from Kazakhstan to China), the Rockies Express natural gas pipeline system in the United States of America and the Trans-Panama oil pipeline in Panama. Several other large-scale projects are under consideration, including gas pipelines from Myanmar to China from West Asia to India, from the Russian Federation to China and from North Africa to Europe. The eventual completion of their construction may significantly alleviate the increasing bottlenecks in international shipping.

20. Geographical conditions can pose particular disadvantages with regard to the development of transport infrastructure. Many of the small island developing States often experience transport and trading cost disadvantages as the volumes of their maritime and other transport services are often comparatively small. Similarly, some mountainous and landlocked countries also face particular challenges in the development of transport infrastructure and in their participation in international trade and travel. For many landlocked least developed countries in sub-Saharan Africa, their prospects for economic development are constrained by high transport costs.

21. Transport and related industries, including the automobile industry, and employment in these sectors have been seriously affected by the current global financial and economic crisis. The crisis has caused significant decreases in global production and international trade in 2008 and 2009, first in the developed countries and then in developing countries. Exports from developing countries in the Asian and Pacific region have been among the most seriously affected, declining by 26 per cent.[8]

22. Impacts of the financial crisis on maritime transport and the shipbuilding and ship-operating industries have been analysed by UNCTAD. Recent postponements and cancellations of shipbuilding contracts may have major impacts on shipbuilding countries, such as China, the Republic of Korea and Viet Nam, while intensified scrapping of older tonnage may pose further challenges for safety, health and environmental conditions in major ship-breaking countries, such as Bangladesh and Pakistan.

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[8] World Trade Organization, *World Trade Report 2009: Trade Policy Commitments and Contingency Measures*, Geneva, WTO, 2009.

23. Cruise shipping is a rapidly growing tourist industry that has been less affected by the financial crisis than the previously mentioned industries. Cruise Lines International Association has estimated that some 13.5 million passengers, mostly from North America, would take a cruise ship holiday in 2009. Large cruise ships can accommodate 3,000 to 6,000 passengers. However, such vessels generate a number of waste streams that can result in discharges into the marine environment, these include sewage, grey water, oily bilge water, ballast water, solid waste and hazardous waste. If not properly treated and disposed of, such wastes can become a significant source of pathogens, nutrients and toxic substances potentially threatening to human health and aquatic life, particularly in environmentally pristine coastal areas.

24. A variety of models and scenario projections have been developed by IEA, the World Energy Council, the Stockholm Environment Institute, the World Business Council for Sustainable Development and other organizations that project transport demand, necessary investments, energy needs and the associated increases in GHG emissions and impacts on the process of climate change for the intermediate and long-term future to 2030, 2050 and 2100. Many model calculations made before the start of the recent financial crisis did not anticipate such a situation and therefore may need to be adjusted. However, most model and trend analysts agree that the global economy is on a path to roughly double, or even triple, its energy use and carbon dioxide emissions by 2050 unless decisive policy interventions are made soon.

B. Rural transport infrastructure and lack of access to transport services in developing countries

25. Inadequate transport infrastructure and lack of access to affordable transport services are often cited as factors that perpetuate poverty while posing major obstacles to countries' progress towards the achievement of the Millennium Development Goals, particularly in rural areas. According to World Bank estimates[9] more than 1 billion people living in rural areas still do not have access to adequate transport and 98 per cent of them are in developing countries.

26. Physical isolation is a strong contributor to poverty and the marginalization of rural communities. Small-scale and subsistence farmers, women and children are particularly affected. A disproportionate burden is placed on rural women, especially those living in regions of sub-Saharan Africa, who spend a major part of the day in travel and transport just to meet household subsistence needs.

[9] The World Bank Rural Access Index measures the number of people in rural areas who live within 2 km (typically equivalent to a 20-25-minute walk) of an all-weather road as a proportion of the total population.

Box 1

Positive impact of rural transport and enhanced mobility on the achievement of the Millennium Development Goals

Goal 1: Eradicate extreme poverty and hunger	• Facilitates access to job opportunities and markets • Improves food security by increasing (agricultural) production and distribution efficiency • Lowers agricultural input prices • Reduces the monopoly power of (agricultural) traders/middlemen
Goal 2: Achieve universal primary education	• Facilitates or enables access to education facilities and literacy • Prevents isolation of rural communities, attracts teachers • Relieves travel time for domestic tasks (barrier to attendance, particularly for girls)
Goal 3: Promote gender equality and empower women	• Decreases time for women's daily chores (e.g. water collection) • Empowers women to take more control over their lives by increasing their access to markets, their exposure to education and information and their opportunities to participate in income-generation, community and political activities • Levels the balance of equality in gender relations
Goal 4: Reduce child mortality **Goal 5:** Improve maternal health **Goal 6:** Combat HIV/AIDS, malaria and other diseases	• Facilitates access to health facilities and services (e.g. skilled birth attendants), medicines and supplies • Enables health educators to visit communities more frequently • Enables education, vaccination, disease prevention campaigns • Makes possible the safe and timely delivery of vaccines • Provides access to safe and clean water that enhances hygiene • Reduces critical secondary injuries during transportation (particularly for pregnant women) • Increases health-care-seeking behaviour of communities
Goal 7: Ensure environmental sustainability	• Enables waste management • Facilitates access to natural resources • Supports (natural) disaster management and rehabilitation activities
Goal 8: Develop a global partnership for development	• Attracts visitors, tourists and investors • Empowers communities and individuals through mobility • Supports political mobilization and interaction with governmental representatives

Source: Adapted from International Forum for Rural Transport and Development (www.ifrtd.org/mdgs.htm).

27. Rural roads are characterized by light traffic (fewer than 50 vehicles per day) and include engineered roads and bridges, as well as trafficable tracks and trails. The main purpose of people taking trips in rural areas is to buy provisions, sell crops/products, pursue education, process agricultural products, fetch water, collect fuel wood, access medical care, visit family and friends, commute to places of work and obtain official documentation. The most commonly used transport modes remain motorcycles, bicycles, barrows, carts, small boats and walking, often with goods loaded on the back or head. Owing to low population densities in remote rural areas, adequate public transport services are rarely available.

28. As demonstrated by the success of the large-scale rural roads project sponsored by the Government of India and the World Bank, basic rural transport infrastructure and services can significantly improve rural farm and non-farm incomes. The project for the period 2004-2010 is aimed at connecting all villages with more than 500 people, that is, a total of about 180,000 villages in certain states, utilizing new or improved all-weather roads. In many villages, household incomes have risen by 50-100 per cent on average as a result of the project. In many states, the project has enabled increased agricultural yields and productivity, improved literacy and diversification of the rural economy. Farmers receive better prices for their products when they can access markets directly, thus cutting out middlemen and reducing the spoilage of perishable products.

29. The impact of rural road programmes on rural employment and income generation can be ensured through the use of appropriate technologies, local contractors, local workers and local materials. Disaster relief and food-for-work types of transport infrastructure project can also contribute to rural poverty reduction.

Box 2
Small-scale and self-help projects in developing rural transport

Sri Lanka: Community bus project. In Ratnapura district, people in three villages worked with the Lanka Forum for Rural Transport and Development and Practical Action (formerly the Intermediate Technology Development Group) to introduce a community bus service. After a decade, villagers enjoy newer bus and improved road conditions as they continue to benefit from cheaper and more reliable access to the local school, health centre and market.

Nepal: Bicycle ambulances. For several remote communities, bicycle ambulances provide people with a vital lifeline, enabling farmers to reach medical centres more quickly.

Guatemala: Labour-based road-building. In an effort to improve rural access, the Government of Guatemala conducted a programme to construct, rehabilitate and maintain rural roads, using labour-based work methods. This programme resulted in the building of 2,100 km of rural roads.

Ghana: Women market traders in the driving seat: A Transaid project in Accra is assisting market women to own, manage and control their own fleet of small vans to help reduce the transport burden they face. The women are trained to drive, maintain and implement cost-effectively their own transport management system.

Zambia: Community-driven market access roads: A project financed by the International Fund for Agricultural Development and the Government of Zambia to design and construct improved market access roads is benefiting thousands of villagers in southern Zambia through improved food security, employment for women and improved safety of schoolchildren.

Azerbaijan: Road rehabilitation makes economic growth accessible for remote communities: With the support of the United States Agency for International Development, seven village communities in Lerik district formed a community development council and initiated work to expand and rehabilitate more than 12 km of road surface.

Source: Practical Action, United States Agency for International Development, Transaid and International Fund for Agricultural Development, among others.

30. Although many successful rural transport projects and programmes have been implemented in all regions of the world, including the Sub-Saharan Africa Transport Policy Programme of the World Bank and the Economic Commission for Africa (ECA) in Africa, significant additional investments in rural infrastructure and transport systems are crucial for improving the living conditions of rural populations. As shown in the examples in box 2, even small investments can make great differences in the lives of the rural poor, but larger programmes with public and international funding are needed to overcome the widening development gap. The importance of the principle of increasing the access of people in rural areas to transport infrastructure and services was also highlighted by the Forum of Asian Ministers of Transport at its first session held at the ESCAP secretariat in Bangkok on 17 and 18 December 2009.[10]

C. Urban transport

31. In Agenda 21, all countries were called upon to (a) integrate land use and transportation planning in order to encourage development patterns that reduce transport demand; (b) adopt urban transport programmes favouring high occupancy, as appropriate; (c) encourage non-motorized modes of transport by furnishing safe cycleways and footways in urban and suburban centres in countries, as appropriate; (d) devote particular attention to effective traffic management, efficient operation of public transport and maintenance of public infrastructure; (e) promote the exchange of information among countries and representatives of local and metropolitan areas; and (f) re-evaluate current consumption and production patterns in order to reduce the use of energy and natural resources.

[10] Bangkok Declaration on Transport Development in Asia.

32. Urban transport poses great challenges in many of the rapidly growing metropolitan and other urban areas of developing countries where lack of adequate planning and public transport services causes economic losses due to high consumption of fuels, congestion and air pollution caused by sulphur oxides, nitrogen oxides, volatile organic compounds and particulates, with their associated impacts on public health. According to UN-Habitat projections, by 2050, two thirds of humanity will live in towns and cities. Hence, cities in developing countries urgently need affordable high-quality public urban transport systems.

33. Urban planners face the challenge of balancing an appropriate separation and mix of residential, industrial, commercial and recreation zones so that jobs, markets and residences would not be separated by long distances. Adequate provision of safe routes for cycles and parking facilities could enhance sustainability in urban transport systems. Similarly, policies to support walking as a prime mode of transport through the provision and maintenance of walkways could also be effective in urban areas. Many European cities and towns have successfully restricted motor vehicle use in commercial centres by introducing pedestrian-only shopping zones.

34. Subway and light-rail systems form the basis for rapid, cost-effective and environmentally benign urban passenger transport. For example, 116 cities, located mostly in the industrialized countries, operate their own metro systems, which are used by an estimated 155 million passengers each day. In addition, there are about 400 light-rail systems worldwide, while over 200 new systems are being planned. However, the construction of subways in existing cities poses major challenges and is often a very costly undertaking, and thus not easily affordable for developing countries, even though tunnel construction technologies are now very advanced.

35. A growing number of cities in developing countries (see also the annex to the presented report) have embarked on, or are considering, the introduction of bus rapid transit (BRT) systems, which are characterized mostly by larger buses that run on segregated lanes parallel to the local traffic. In comparison with light-rail transit or subway systems, BRT systems are much less costly while still achieving comparable high transport efficiency. Enhanced BRT systems offer climate-controlled buses with platform-level entry, pre- or post-fare payment and global positioning systems to inform customers of expected waiting times and transfer connections. Modern BRT systems can move up to 45,000 passengers per hour along a single route direction compared with fewer than 10,000 passengers for mixed traffic on the same corridor.

36. Bus rapid transit and other urban public transport systems offer many direct and indirect local, national and global benefits. A recent study for Mexico City, in which the costs and benefits of a BRT system were estimated and monetized, demonstrated that the sum of public benefits, including economic time saved and health and fuel costs avoided, by far exceeded the costs of BRT systems. In addition, BRT and other public transport infrastructure investments help to avert the emissions of significant amounts of GHG. Several initiatives, including the international Partnership on Sustainable Low Carbon Transport, and studies have been launched recently to explore the possibility of eventually including BRT and other public transport projects in nationally appropriate mitigation actions in a future climate change agreement and emissions trading system.

37. Although the costs of individual buses and BRT systems are moderate, many such systems are urgently needed to enable developing countries to tackle growing urban transport problems. For many developing countries, BRT systems would be affordable only if they attract significant international technical and financial support.

38. The private sector and public-private partnerships can play an important role in financing and managing urban public transport systems. At the same time, the promotion of public transport can be successful only if fares remain affordable, including for the urban poor. This implies that public transport operators may have to be subsidized or remunerated for the public health, socio-economic and environmental benefits that they generate.

39. A growing number of developing countries are dedicating their various capacities to produce or assemble buses domestically. Perspectives for greater North-South and South-South cooperation could be explored, with a view to improving quality and realizing further cost reductions.

40. Area licensing, road pricing and parking charge schemes, such as those applied in Singapore, London and Paris, have proven effective in terms of reducing urban vehicular traffic. Some cities, particularly those where air pollution poses a major threat to human health, have implemented temporary restrictions on the use of cars, such as by certain days of the week, numbers on licence plates or minimum passenger occupancy. Public information and public health campaigns advocating car-free days or temporary road closures for biking, walking or street markets have also become increasingly popular.

41. In a growing number of cities, new urban planning and innovative business concepts, including car-free housing, car-sharing, short-term car rentals[11] and "dial-a-ride" services, as well as company bicycles and urban bicycle rental schemes, are offering new low-carbon transport options. In many capitals and most larger cities in Europe, bicycles are now easily available for rent at major train or subway stations.

42. Since the adoption in 2006 of the Convention on the Rights of Persons with Disabilities[12] transport planners in many countries have initiated additional projects and programmes to provide persons with disabilities better and more equal and affordable access to transport and personal mobility, particularly in urban public transport systems.

D. Integrated planning of regional, inter-urban and cross-border transport systems

43. A three-pronged approach is recommended for making transport systems more sustainable. The first prong is to avoid unnecessary transport through better spatial planning and other measures. In the Netherlands, a new multi-stakeholder partnership involving a group of large corporations set an example in reducing traffic congestion and the associated waste of time and energy by staggering work hours for employees and by introducing telecommuting and videoconferencing. As a

[11] For example, www.zazcar.com.br (Brazil), www.zipcar.com (United States of America), www.dbcarsharing.de (Germany).

[12] See General Assembly resolution 61/106.

result, traffic volume and congestion have been reduced in several cities, particularly during rush hour.

44. The second prong relates to the promotion of modal shifts, favouring transport modes with high transport and fuel efficiency, such as high-speed passenger trains or rail and barge freight on inland waterways. In Europe and Japan, the average energy consumption per passenger-kilometre for high-speed rail transport is generally one third to one fifth lower than that for airplane or car use. Freight transported by truck is more versatile and flexible than other means; therefore, it is the preferred mode for transporting many types of goods. Nonetheless, in many countries shifting freight from road to rail, where possible, may increasingly be in the public interest in view of the environmental advantages that such a shift would entail.[13] Optimization of the necessary infrastructure for intermodal integration of rail and road, together with ports and airports, offers considerable challenges, as well as opportunities for the realization of economic, social and environmental benefits.

45. The third prong is to improve efficiency for all modes of transport that contribute significantly to reductions in emissions and air pollution while saving energy. Section G of the present report elaborates the various regulatory and fiscal policy tools available to promote modal shifts, increase fuel economy and efficiency and enhance the internalization and reduction of negative environmental effects.

E. Transport safety

46. Comprehensive periodical assessments of the global status of road safety are conducted by WHO.[14] Worldwide, an estimated 1.2 million people are killed in road accidents each year and as many as 50 million are injured, with about 90 per cent of such accidents occurring in low- and middle-income countries.

47. Separating different modes of transport through appropriate infrastructure and, where possible, through crossing-free intersections can greatly reduce the number of traffic-related accidents. Road safety concerns need to be fully integrated into transport planning. Permanent, seasonal or other temporary speed limits, driver safety and ecotraining programmes, mandatory seat-belt or cycling-helmet requirements and public awareness campaigns are all proven tools for preventing accidents and serious injuries.

48. In resolution 62/244, the General Assembly welcomed the offer of the Government of the Russian Federation to host a global ministerial conference on road safety; the conference, the first of its kind, was held in Moscow on 19 and 20 November 2009. In its declaration, the conference called upon the General Assembly to declare the period 2011-2020 as the "decade of action for road safety".

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[13] See, for example, the European Union programme promoting modal shift at http://ec.europa.eu/transport/marcopolo/home/home_en.htm.

[14] World Health Organization, *Global Status Report on Road Safety: Time for Action*, Geneva, WHO, 2009.

F. Transport and climate change

49. The transport sector is responsible for almost a quarter of the emissions of GHGs from fossil fuel sources and it is the fastest-growing sector with respect to such emissions, yet international climate initiatives and support programmes have paid little attention to these factors.

50. Whereas GHG emissions in some other economic sectors decreased slightly between 1990 and 2007, emissions from transport in the industrialized countries listed as Annex I Parties to the United Nations Framework Convention on Climate Change have increased significantly, that is by 17 per cent on average. Hence, as a group, Annex I Country Parties to the Convention are not likely to achieve the emission reduction targets agreed under the Kyoto Protocol.[15]

51. In 2006, aggregate global emissions of carbon dioxide from the transport sector were over 6.45 gigatons of carbon dioxide. Road transport accounted for 73 per cent of these emissions, aviation for 11 per cent, international shipping for 9 per cent, inland navigation for 2 per cent, rail for 2 per cent and other traffic for the remaining 3 per cent. Transport also accounts for a large share of black carbon particulate emissions, which can also contribute significantly to the process of climate change.[16]

52. Motor vehicle fuel economy and emission standards offer important policy options for mitigating the effects of climate change. Existing regulatory approaches differ considerably among countries, depending on technical definitions of standards, vehicle categories and weight classes, as well as test-driving cycles. Several countries have introduced mandatory standards, while others still rely on voluntary approaches and industry self-regulation. In many countries, the average fuel economy has gradually improved since standards were first introduced in the mid-1970s. However, significant further review of these regulations will be required if the projected increase in global carbon dioxide emissions is to be curbed. The United States has recently increased its corporate average fuel economy regulation standards, with a view to improving vehicle fuel economy in order to attain 35.5 miles per gallon in 2016 (equivalent to 6.6 litres/100 km).[17]

53. Several new initiatives and international partnerships have been formed to support multi-stakeholder collaboration on fuel economy, including the Low Carbon Vehicle Partnership based in the United Kingdom and the Global Fuel Economy Initiative of UNEP, IEA, the International Transport Forum and the FIA Foundation for the Automobile and Society.

54. Retail prices for motor fuels differ considerably from country to country, even up to a factor of eight, for various reasons, including different types and levels of taxation.[18] Agricultural vehicles and machinery, as well as most trucks, buses and commercial vehicles, commonly use diesel fuel, which is often taxed and priced at lower levels than gasoline. However, fuel price subsidies have a disadvantage: they

[15] FCCC/CP/1997/7/Add.1, decision 1/CP.3, annex.

[16] See V. Ramanathan and G. Carmichael, "Global and regional climate changes due to black carbon", in *Nature Geoscience*, vol. 1.

[17] United States Government, Department of Transportation: *Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Year 2011* (www.nhtsa.dot.gov/portal/fueleconomy.jsp).

[18] German Agency for Technical Cooperation, *International Fuel Prices 2007*, 5th ed. Eschborn, Germany, GTZ, 2007.

cannot be clearly targeted, and other users and affluent constituencies can benefit equally along with the poor and less affluent. One of the challenges faced by fiscal policymakers is to design and implement fuel and motor vehicle taxes and subsidies in such a manner that negative external effects, including emissions and their impacts, could be internalized and reduced. Countries which continue to subsidize motor fuels may consider alternative options in order to support more directly eligible industries or the poor. Higher fuel taxes can discourage the wasteful use of energy, contribute to lower levels of emissions and generate revenues that can be used to finance public transport projects. A growing number of countries are promoting the use of liquefied petroleum gas and compressed natural gas, as well as synthetic fuels, in order to reduce local air pollution.

55. Whereas fuel efficiency is important for the operation of commercial vehicles, such as trucks and taxis, passenger cars are frequently seen as representing the owners' social status. Modern designs, greater engine power, increased seating capacity and additional features tend to attract consumers more interested in such aspects than fuel efficiency. As long as the majority of affluent consumers associate sizeable cars and high resource use with elevated social status, the marketing of small fuel-efficient vehicles will face formidable challenges.[19] A number of countries have mandated that consumers be provided with information on describing the fuel economy labels of cars for sale in order to create a greater consumer preference for fuel economy.

56. Both ICAO and IMO project a significant resumption of growth in the global demand for air and maritime transport, which is expected to substantially exceed any future gains in fuel efficiency. Some estimates suggest that there are currently some 10,000 aircraft in the sky at any given time of day worldwide. Recent projections by ICAO suggest that the global fleet may actually increase from the 18,773 aircraft which were in service in 2006 to more than 44,000 aircraft by 2036. Emissions from aircraft have the potential for producing greater impacts on the process of climate change than other sources as they enter the atmosphere at high altitudes. The European Parliament recently adopted legislation which foresees the inclusion of intra-European air travel, as well as international air travel commencing in or arriving in countries of the European Union, in the pan-European emission reduction and trading scheme.[20] Inclusion of GHG emissions from international shipping and aviation in a future climate change agreement is urgently needed and is currently under discussion under the United Nations Framework Convention on Climate Change.

57. A very small but growing portion of emissions from transport is offset by travellers or tour operators through the purchase of carbon credits which provide (co)financing for environmental conservation and GHG reduction projects. Several airlines and tour operators offer carbon-neutral travel services. Extrabudgetary support provided by donor countries has also enabled the United Nations to organize a growing number of conferences in a carbon-neutral manner.

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[19] Wolfgang Sachs, *For Love of the Automobile: Looking Back into the History of our Desires* (translated from the German by Don Reneau), Berkeley, CA, University of California Press, 1992.

[20] Directive EC/2008/101 of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community.

58. Currently, no common set of internationally recognized indicators exists for measuring, reporting and verifying national and international action on mitigating the process of climate change as it relates to the transport sector. The harmonization of methodologies and greater international support for developing countries in their efforts to improve their databases constitute important prerequisites for the eventual inclusion of transport projects in future emission monitoring and trading systems.

G. Transport technologies: developments and prospects

59. Significant improvements in transport technologies and ground-breaking innovations are urgently needed to address the challenge of making transport sustainable.

60. Considerable potential exists for increasing fuel economy and reducing carbon dioxide emissions with existing motor vehicle technologies, by reducing vehicle size and weight, and rolling and air resistance, as well as accessory loads. The Global Fuel Economy Initiative partnership has estimated that vehicle fuel efficiency of approximately 4 litres per 100 km is achievable using existing technologies. Greater use of advanced direct-injection engines, as well as hybrid drive-trains and turbochargers could raise fuel efficiency. Several studies suggest that fuel-efficient tyres could also help to save up to 5 per cent or more of the fuel consumed by motor vehicles. A scheme of fuel efficiency labelling for car tyres has been proposed for consideration by the European Parliament.

61. High levels of emissions from older vehicles are largely due to poor maintenance. Mandatory periodical technical inspections could significantly contribute to reduced air and noise pollution, as well as road safety. Effective enforcement of existing regulations and the adoption of adequate air quality and emission control standards could offer low-cost options for enhancing the sustainability of transport.

62. Several countries launched economic stimulus programmes in 2009, with a focus on the car industry. Some of these programmes are aimed at accelerating the scrapping of older cars and increasing the rate of change in the vehicle fleet towards more fuel-efficient models. Some countries have also passed legislation, including obligations for car manufacturers to increase the rate of recycling of motor vehicle parts and materials. Many of these initiatives have made important contributions to the "greening" of economic growth, safeguarding existing jobs and creating new ones while simultaneously reducing the environmental footprint of the transport sector both now and in the future.

63. Many second-hand vehicles are exported from industrialized countries to developing countries. The restrictions that developing countries place on such imports are important in preventing high-emitting, unsafe or unsuitable older cars from being imported into such countries. Some developing countries have banned altogether the importation of used motor vehicles.

64. Poor-quality fuels can also contribute to poor performance and negative environmental impacts. Including lead additives in fuel was banned in most countries after such chemicals had been found to have serious implications for human health. The presence of lead in gasoline also greatly impedes the treatment of exhaust with catalytic converters. The Partnership for Clean Fuels and Vehicles of

UNEP has successfully assisted many developing countries to reduce vehicular air pollution through the promotion of lead-free, low-sulphur fuels and cleaner vehicle standards and technologies. The partnership has achieved an almost complete global phase-out of leaded gasoline.

65. Another pollutant commonly found in fuel is sulphur, which is contained in varying quantities in different crude petroleum stocks. Refining processes can remove sulphur from fuel, but doing so raises production costs. Heavy fuel oil used in maritime shipping often contains high levels of sulphur. In order to reduce air and maritime pollution in coastal areas, a growing number of countries are implementing regulations to progressively limit the sulphur content in fuel used for shipping.

66. Investment in biofuel production has increased significantly, particularly during recent periods when oil prices reached high levels. Biofuel production nearly tripled between 2000 and 2007; currently it accounts for about 2 per cent of global fuel consumption for transport.[21] A growing number of countries support the production of biodiesel and ethanol through subsidies, reduced taxes and regulations requiring mandatory blending of biofuels with petrol or diesel fuel. Research at local and national levels is essential to assess comprehensively all ecological and other impacts in this regard. Second-generation and advanced biofuel technologies based on non-edible feedstocks, such as cultivated algae, could make a significant contribution to sustainable development. Also under study is the potential use of biofuels in aviation.

67. Mobile air-conditioning systems tend to increase the fuel consumption of cars and concomitantly their GHG emissions by 2.5-7.5 per cent.[5] The leakage of environmentally harmful refrigerants still poses a considerable challenge, particularly in developing countries. Progress has been made in limiting such emissions through implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer.[22] The rapid switch from the refrigerant dichlorodifluoromethane (CFC-12) to 1,1,1,2-Tetrafluoroethane (HFC-134a) has led to a decrease in carbon dioxide emissions from mobile air-conditioning systems from about 850 million tons of CO_2-sq to 609 million tons between 1990 and 2003, despite the continued growth of air-conditioned vehicle fleets globally. However, further research into and testing of other alternative refrigerants with a lower potential for contributing to global warming, including 1,1-difluoroethane (HFC-152a) and carbon dioxide (R744), are still needed. Training programmes, certification of service professionals, as well as adequate disposal practices, are also urgently needed in developing countries to further reduce the leakage of refrigerants.

68. Electric vehicle propulsion technologies are expected to play a greater role in the future than they do now. A growing number of vehicle manufacturers have announced plans or have started producing electric vehicles, primarily for use in urban areas. In several countries, including China, electric bicycles have become very popular. In Israel and in several other countries, including France and the United Kingdom, pilot projects have been launched with the aim of introducing

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[21] See Food and Agriculture Organization of the United Nations, *The State of Food and Agriculture 2008: Biofuels: Prospects, Risks and Opportunities*, Rome, FAO, 2008 (www.fao.org/docrep/011/i0100e/i0100e00.htm), and Third World Network (www.twnside.org.sg/).

[22] United Nations, *Treaty Series*, vol. 1522, No. 26369.

electric vehicles in larger numbers, together with networks of service stations for rapid on-site battery exchange and battery charging. In Iceland, a pilot project has introduced a number of public fuel-cell buses powered by hydrogen obtained from water electrolysed by using renewable energy. In enabling a solar-powered prototype vehicle to drive around the world, the Switzerland-based "Solartaxi" project has shown that a combination of mobile and stationary photovoltaic panels and high-efficiency batteries can make carbon-free mobility possible at relatively affordable costs.[23] Technologies for using solar energy in maritime shipping and aviation, and wind energy in shipping are also being developed and tested.

69. When assessing GHG mitigation options it is important to consider life cycle impacts. This is especially true for making choices among available alternative fuels or technologies. Electricity and hydrogen can offer important opportunities to de-carbonize the transport energy system, but the realization of full-cycle carbon reduction depends upon the way in which the electricity and hydrogen are produced. Therefore, greater use of electricity or hydrogen for private motor vehicles would be sustainable only if such future systems are increasingly based on renewable sources of energy.

70. Significant increases in public and private funding will be needed to enhance the development, testing, demonstration, commercialization and dissemination of new sustainable low-carbon transport technologies, transport fuels and fuel storage systems, including durable high-capacity and high-efficiency batteries for electric vehicles. Attractive incentives could also play an important role in motivating the invention of sustainable transport technologies and advances. Larger-scale production of affordable electric vehicles will require a number of alternative materials, notably lithium, for which new industries and sustainable mining and processing technologies will need to be developed.

71. New information technologies, such as global positioning and intelligent transportation systems, including "smart highway" systems, provide various opportunities to facilitate traffic flows, reduce pollution levels and increase transport safety.

72. The majority of clean fuel and alternative vehicle technologies are available predominantly in industrialized countries. The development of alternative vehicle technology requires significant capital investment for research and design that is unavailable in most developing countries. Accelerated deployment of sustainable transport systems for all will not be possible without systematic and much greater technology sharing and technology transfer to developing countries than is currently taking place.

H. Intergovernmental cooperation

73. All regional commissions emphasize the importance of transport for sustainable development and facilitate the intraregional and interregional exchange of experience, as well as technical cooperation activities. The Inland Transport Committee of the Economic Commission for Europe (UNECE) has established a comprehensive framework of 57 international agreements and conventions related to cross-border infrastructure networks, uniform and simplified border-crossing

[23] For further information see www.solartaxi.com.

procedures and other norms related to efficiency, safety and environmental protection. The Intergovernmental Agreement on the Asian Highway Network[24] and the Intergovernmental Agreement on the Trans-Asian Railway Network,[25] facilitated by the Economic and Social Commission for Asia and the Pacific (ESCAP), came into force in July 2005 and June 2009, respectively. The Agreement on International Roads in the Arab Mashreq[26] and the Agreement on International Railways in the Arab Mashreq,[27] facilitated by the Economic and Social Commission for Western Asia (ESCWA), have been in force since 2003 and 2005, respectively.

74. As the secretariat for the Convention on International Civil Aviation,[28] ICAO coordinates and regulates international air travel. Since the 1970s, ICAO has pursued common international policies, standards and regulations for environmental protection, focusing on aircraft noise, local air quality and global climate impacts. The convention exempts aviation fuels from taxation. In 2007, the ICAO Assembly established the high-level Group on International Aviation and Climate Change with a view to formulating the ICAO Programme of Action on International Aviation and Climate Change.

75. IMO helped develop the International Convention for the Control and Management of Ships' Ballast Water and Sediments[29] which was adopted in 2004. It requires all ships to conduct ballast water management procedures to a given standard. As of July 2009, 18 States have ratified the convention, representing 15 per cent of the world's gross tonnage. The IMO International Convention on the Control of Harmful Anti-Fouling Systems on Ships[30] was adopted in 2001 and entered into force in September 2008. IMO Member States also reviewed the Protocol of 1997 (Annex VI — Regulations for the Prevention of Air Pollution from Ships) to the International Convention for the Prevention of Pollution from Ships, 1973,[31] as modified by the Protocol of 1978 relating thereto. It calls for a progressive reduction in sulphur oxides, nitrogen oxides and particulate emissions from ships.

III. Continuing challenges

76. The systematic integration of economic, social and environmental considerations in all aspects of transport policymaking and land-use planning remains a key principal objective, as already envisaged in Agenda 21 and the Johannesburg Plan of Implementation.

77. The international community, in its efforts to promote a sustainable transport future for all, continues to face considerable barriers and multiple challenges, some of which appear to be even greater now than in the past. Policymakers for transport, development and the environment urgently need to find feasible common

[24] United Nations, *Treaty Series*, vol. 2323, No. I-41607.

[25] See *Official Records of the Economic and Social Council, 2009, Supplement No. 19* (E/2009/39-E/ESCAP/65/32), para. 67.

[26] See E/ESCWA/TRANS/2002/1/Rev.2.

[27] See E/ESCWA/TRANS/2001/3).

[28] United Nations, *Treaty Series*, vol. 15, No. 102, p. 295.

[29] See International Maritime Organization, document BWM/CONF/36, annex.

[30] See International Maritime Organization, document AFS/CONF/26, annex.

[31] See United Nations, *Treaty Series*, vol. 1340, No. 22484.

approaches and ways of expanding transport services for sustainable development, while enhancing without delay an effective, comprehensive and rapid transition to more sustainable environment-friendly low-carbon transport systems.

78. Leading researchers, including those working with the International Panel for Sustainable Resource Management established by UNEP, have also pointed out the need, as well as the many opportunities, to work towards a decoupling of wealth and natural resource use.[32] For increasing resource productivity in transport, a comprehensive approach is required that seeks to (a) avoid or reduce transport demand, where possible, (b) encourage a shift towards less polluting and more efficient transport modes, and (c) improve and deploy clean transport technologies.

79. In developing countries, expansion of adequate transport infrastructure and environmentally benign and affordable transport services is urgently needed in urban and peri-urban and particularly in rural areas, in order to facilitate and enhance the attainment of the Millennium Development Goals, including reduction of poverty and improvement of physical access to public services, such as health care, education and markets. Safety, and social and gender concerns need to be better integrated into transport policies for development to be sustainable.

80. In industrialized countries, in the wake of the financial crisis of 2008-2009, many workers in the automotive industry and other transport services have lost their jobs and income. While continued and effective temporary government intervention and support remain urgently needed to cope with the social impacts, the crisis also offers policymakers many opportunities to provide incentives for a "greener" and more sustainable transport economy as a part of their economic recovery and stimulus packages.

81. Experience has shown that efforts to reduce the use of private motor vehicles in densely populated urban areas or commercial centres are more successful wherever they are affordable and, if needed, subsidized public transport alternatives are available. Urban bus rapid transit systems will have a particularly important role to play in providing sustainable transport options in developing countries and in their rapidly growing cities. Greater international financial support for investment in sustainable low-carbon public transport systems could significantly enhance the mitigation of the climate change process.

82. Travel activity related to tourism is projected to continue to increase worldwide, particularly in industrialized and newly industrializing countries. Preventing increased resource use, environmental impacts and unsustainable patterns of consumption in tourism remains a great challenge. Greater public awareness and promotion of eco-tourism could enhance more sustainable development of tourism.

83. National and international public-private partnerships, international financing institutions and the private sector could all make important contributions to the development and implementation of sustainable transport policies and projects.

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[32] Ernst von Weizsäecker, Karlson "Charlie" Hargroves, Michael H. Smith, Cheryl Desha, Peter Stasinopoulos, *Factor Five: Transforming the Global Economy through 80% Improvements in Resource Productivity*, London and Sterling, VA, United States, Earthscan, 2009.

84. Enhancing active public participation of all stakeholders and the identification of possible "win-win-win" approaches are essential prerequisites for mobilizing public support.

85. With effective regulatory frameworks and active public policy interventions, a more sustainable transport future for all is achievable. The Commission may wish to consider seizing the opportunity to map out a new vision and action plan on transport for sustainable development as an outcome of its policy debate in 2011.

Annex

Comparison of recent bus rapid transit system characteristics

	Bogotá	*São Paulo, Brazil*	*Quito*	*Mexico City*	*Jakarta*	*Hangzhou, China*	*Istanbul*	*Johannesburg, South Africa*
System	TransMilenio	Interligado	Central Norte	Metrobus	Transjakarta	Hangzhou Metro	Metrobus	Rea Vaya Phase 1a
Year	2000	2003	2004	2005	2004	2006	2006	2009
Total length (km)	**84**	**104**	**12.8**	**20**	**37**	**27.2**	**41**	**28.5**
Feeders length (km)	212			0	—	0		
Stations	**104**	327	**16**	**34**	**63**	**16**	**32**	**20 (27)**
Terminals	10	24	1	2	4	1	2	—
Fare collection	Smart card	Smart card	Paper ticket	Smart card	Electronic	Smart card	Electronic transit pass	Smart card
Number of trunk vehicles	841 articulated 344 feeder	1 073 articulated 12 638 other	74	97	162	48	274	41 articulated 102 standard size
Passenger capacity	160	100	160	160	—	160	150 articulated 230 double articulated	112 articulated 75 standard
Passenger trips per day	**1 450 000**	**2 780 000**	**120 000**	**260 000**	—	**40 000**	**600 000**	**69 000**
Peak ridership	45 000	20 000	6 400	8 500	3 200	1 500	17 000	
Average speed	26 km/h	18 km/h	23 km/h	19 km/h	17 km/h	24 km/h	41 km/h	
Average maximum waiting time at peak	3 minutes	30 seconds	2 minutes	63 seconds		2 minutes	1 minute	5 minutes
Fare (in United States dollars)	0.51	1.05	0.25	0.35	0.39	0.40	1.50	

	Bogotá	São Paulo, Brazil[a]	Quito	Mexico City	Jakarta	Hangzhou, China	Istanbul	Johannesburg, South Africa
Planning cost (in millions of United States dollars)	5.3	n/a	n/a	n/a	n/a	0.05	n/a	n/a
Total infrastructure cost (in millions of United States dollars per kilometre)	**8.2**	**3.5**	**1.4**	**1.5**	**1.35**	**0.7**	**5.7**	**6.2**

Source: Institute for Transportation and Development Policy (ITDP), Bus Rapid Transit Planning Guide, New York: Global Environment Facility, German Agency for Technical Cooperation, UNEP, Viva (York Region Rapid Transit Plan) and ITDP, 2007.

[a] Dario Hidalgo and Pierre Graftieaux, "BRT systems in Latin America and Asia: results and difficulties in eleven cities", paper presented at the 87th Annual Meeting of the Transportation Research Board of EMBARQ, the World Resources Institute Centre for Sustainable Transport, Washington, D.C., 13-17 January 2008.

[b] Dario Hidalgo, EMBARQ: The World Resources Institute Centre for Sustainable Transport.